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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year)

17 March 2000 (17.03.00)

International application No.

PCT/FI99/00636

Applicant's or agent's file reference

48049

International filing date (day/month/year)

22 July 1999 (22.07.99)

Priority date (day/month/year)

23 July 1998 (23.07.98)

Applicant

HARTIKAINEN, Jari et al

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

12 February 2000 (12.02.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

F. Baechler

Telephone No.: (41-22) 338.83.38

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 48049	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/FI 99/ 00636	International filing date (day/month/year) 22/07/1999	(Earliest) Priority Date (day/month/year) 23/07/1998
Applicant NOKIA TELECOMMUNICATIONS OY et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

2



None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

/FI 99/00636

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H0407/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	IERA ET AL.: "Call-Level" and "Burst-Level" Priorities for an Effective Management of Multimedia Services in UMTS" PROCEEDINGS OF IEEE INFOCOM 1996.FIFTEENTH ANNUAL JOINT CONFERENCE OF THE IEEE COMPUTER AND COMMUNICATIONS SOCIETIES.NETWORKING THE NEXT GENERATION., vol. 3, 24 - 28 March 1996, pages 1363-1370, XP000622274 San Francisco, usa the whole document	1-20
A	EP 0 717 579 A (AT&T) 19 June 1996 (1996-06-19) abstract; figures 1-4 column 5, line 4 - line 12 column 8, line 11 - line 20 --- -/--	1,4,10, 13,14



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
 "E" earlier document but published on or after the international filing date
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
 "O" document referring to an oral disclosure, use, exhibition or other means
 "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
 "&" document member of the same patent family

Date of the actual completion of the international search

27 October 1999

Date of mailing of the international search report

05/11/1999

Name and mailing address of the ISA

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Authorized officer

Danielidis, S

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/FI 99/00636

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 11566 A (MOTOROLA INC.) 27 March 1997 (1997-03-27) abstract; figures 1,9,10 page 12, line 12 - line 29 -----	1, 13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

T/FI 99/00636

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
EP 717579	A	19-06-1996	US	5615249 A		25-03-1997
			JP	8237724 A		13-09-1996
<hr/>						
WO 9711566	A	27-03-1997	US	5742592 A		21-04-1998
			EP	0847652 A		17-06-1998
			US	5729542 A		17-03-1998
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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 48049	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI99/00636	International filing date (day/month/year) 22/07/1999	Priority date (day/month/year) 23/07/1998
International Patent Classification (IPC) or national classification and IPC H04Q7/38		
Applicant NOKIA NETWORKS OY et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 7 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 12/02/2000	Date of completion of this report 13.10.2000
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Dominguez, I Telephone No. +49 89 2399 2232 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/FI99/00636

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-14 as originally filed

Claims, No.:

1-20 as originally filed

Drawings, sheets:

1/3-3/3 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/FI99/00636

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	2-14,16,17,19,20
	No:	Claims	1,15,18
Inventive step (IS)	Yes:	Claims	2-14,16,17,19,20
	No:	Claims	1,15,18
Industrial applicability (IA)	Yes:	Claims	1-20
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/FI99/00636

Concerning section V (reasoned statement under Article 35(2))

1. The following documents (D) are referred to in this preliminary examination report:

D1: IERA ET AL.: 'Call-Level' and 'Burst-Level' Priorities for an Effective Management of Multimedia Services in UMTS' PROCEEDINGS OF IEEE INFOCOM 1996.FIFTEENTH ANNUAL JOINT CONFERENCE OF THE IEEE COMPUTER AND COMMUNICATIONS SOCIETIES.NETWORKING THE NEXT GENERATION., vol. 3, 24 - 28 March 1996, pages 1363-1370, XP000622274 San Francisco, usa
D2: EP-A-0 717 579 (AT&T) 19 June 1996 (1996-06-19)
D3: WO 97 11566 A (MOTOROLA INC.) 27 March 1997 (1997-03-27)

2. Due to the broad formulation of their subject-matter, the claims do not meet the requirements of Articles 33(2) and (3) PCT in respect of novelty and inventive step.

3. Cellular telecommunications systems wherein the access to a channel is granted or refused according to a certain priority level of either the subscriber requesting access or of the data to be transmitted are well known in the art, as is described for example in documents D2 or D3. This priority-based access granting procedure may become insufficient when, for example, a single terminal is associated with more than one bearer for the same connection (e.g. multimedia services, which might need several audio and video channels and possibly also data channels).

Taking this priority scheme one step further, document D1 discloses, according to the features of present claim 1, a method for management of bearers in a cellular telecommunications system (see e.g. the abstract) wherein:

- at least two priority data items are associated with each bearer (cf. page 1365, section 3, second and third paragraphs), and
- decisions whether or not to provide services for a bear are based on the value of at least one of said at least two priority data items (cf. page 1366, section 4, third paragraph).

Document D1 does effectively disclose all the features of present claim 1. Therefore, the subject-matter of claim 1 lacks novelty and claim 1 does not meet the requirements

**INTERNATIONAL PRELIMINARY
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International application No. PCT/FI99/00636

of Article 33(2) PCT.

Furthermore, if the subject-matter of claim 1 had been amended so as to overcome the above lack of novelty objection by the introduction of minor implementing details, the attention of the applicant is drawn to the fact that it might have not involved the required inventive step, especially as this document addresses the same problem and provides the same type of solution as the present application.

Therefore, the subject-matter of a such amended claim 1 would have not involved an inventive step, and hence, claim 1 would have not met the requirements of Article 33(3) PCT.

4. Independent claim 15 is considered to be the system counterpart of (method) claim 1. The same reasoning therefore applies.

Hence the subject-matter of claim 15 is not new, and claim 15 does not fulfill the requirements of Article 33(2) PCT.

Similarly, an amended independent claim 15 that would have introduced minor implementing details to overcome the above lack of novelty objection, would have not involved the required inventive step, contrary to Article 33(3) PCT.

5. Independent claim 18 is directed to a radio network controller, having basically the technical features to carry out the method of claim 1.

Again the same arguments set out above under point 3 apply equally to claim 18.

Therefore the subject-matter of claim 15 is not new, contrary to Article 33(2) PCT, and a slightly modified claim 15 (see above) would have not involved the required inventive step, thus not fulfilling the requirements of Article 33 (3) PCT.

6. Nevertheless, reference D1 does not disclose neither suggest the fact, as recited in dependent claim 2, that the bearers can be organized into sets on at least two hierarchical levels, a priority data item being given for each set, nor does it any of the other available prior art documents.

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A new independent claim 1 containing the features of dependent claim 2 combined with those of present claim 1, would therefore have met the requirements of Articles 33(2) and (3) PCT concerning novelty and inventive step.

Dependent claims 3 to 14, renumbered accordingly, would also have met the requirements of Articles 33(2) and (3) PCT, with such a revised independent claim 1.

7. Since dependent claims 16 and 19 (dependent on claims 15 and 18, respectively) are the system (cellular telecommunications system and radio network controller) counterparts of dependent claim 2, an analogous combination of their features with those of independent claims 15 and 18, respectively, would also have led to new independent claims that would have met the requirements of Articles 33(2) and (3) PCT.

Moreover, claims 17 and 20, renumbered accordingly, would also have met the requirements of Articles 33(2) and (3) PCT with such revised independent claims 15 and 18.

Concerning section VII (form and contents).

1. The independent claims should have been drafted in the proper two-part "characterised" form recommended by Rule 6.3(b),(i),(ii) PCT, having a preamble that correctly reflects the nearest prior art, presumably that represented by the above noted D1.
2. In order to meet the requirements of Rule 5.1.(a),(ii) PCT, the relevant prior art, i.e. at least the above noted D1, should have been acknowledged by reference and briefly discussed in the introductory part of the description.
3. All the claims should have included reference signs in parentheses where features shown in the drawings are referred to, Rule 6.2.(b) PCT.
4. The general "spirit and scope" statement in the description at page 14, last line, is unclear, and when used to interpret the claims renders them also unclear, contrary to Article 6 PCT (see PCT-Guidelines for Preliminary Examination, PG-II, 4.17). The

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/F199/00636

statement should therefore have been deleted.

Concerning section VIII (clarity)

1. The expression "at least in part" used in claims 1, 15 and 18 is vague and indefinite and, as such, leaves the reader in a state of uncertainty regarding the scope of protection provided by the feature in question.

2. Claims 4 and 6 do not meet the requirements of Article 6 PCT concerning clarity.

Indeed, the method of claim 4, dependent on "any of the preceding Claims", is "characterized in that one of the hierarchical levels...". However, the hierarchical levels are first mentioned in claim 2, and therefore, the dependency of claim 4 with respect to claim 1 is not clear, since no hierarchical levels appear in claim 1.

In a similar manner, claim 6, dependent also on "any of the preceding Claims" refers to "the same client identity", whilst a client identity is first mentioned in claim 4.

3. Finally, for the sake of clarity the acronym USIM should have been replaced by UMTS Subscriber Identity Module, at least when it first appears in claim 7.

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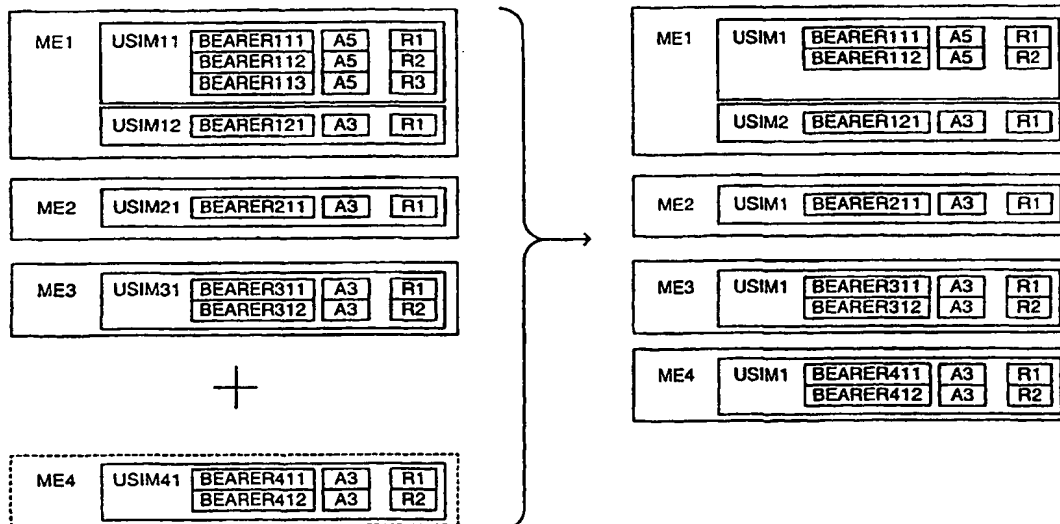
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : H04Q 7/38		A1	(11) International Publication Number: WO 00/05913
			(43) International Publication Date: 3 February 2000 (03.02.00)
(21) International Application Number: PCT/FI99/00636 (22) International Filing Date: 22 July 1999 (22.07.99) (30) Priority Data: 981653 23 July 1998 (23.07.98) FI (71) Applicant (for all designated States except US): NOKIA NETWORKS OY [FI/FI]; P.O. Box 300, FIN-00045 Nokia Group (FI). (72) Inventors; and (75) Inventors/Applicants (for US only): HARTIKAINEN, Jari [FI/FI]; Metsärinne 7 B, FIN-04220 Kerava (FI). PERÄLÄ, Timo [FI/FI]; Vuorenpaikontie 3 A 46, FIN-00820 Helsinki (FI). MARJELUND, Pekka [FI/FI]; Kirjurinkuja 1 E 80, FIN-02600 Espoo (FI). KOHONEN, Pekka [FI/FI]; Kaksoiskiventie 49 C 24, FIN-02760 Espoo (FI). KAUHANEN, Timo [FI/FI]; Länsilenkki 20, FIN-02400 Kirkkonummi (FI). (74) Agent: BERGGREN OY AB; P.O. Box 16, FIN-00101 Helsinki (FI).			(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>

(54) Title: A METHOD AND AN ARRANGEMENT FOR MANAGEMENT OF BEARERS



(57) Abstract

The invention is directed to a method for management of bearers in cellular telecommunication systems in such a situation, when the demand of services is greater than the capacity of the network to provide such services. According to the invention, a set of priority values is associated with each bearer. Preferably, the set of priority values comprises an absolute priority value, which is the same for all bearers associated with a certain USIM, and a relative priority value, which defines the priority order of the bearers associated with a certain USIM. The network uses these priority values to determine, which bearer is dropped, when not enough resources are available.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

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A method and an arrangement for management of bearers

TECHNICAL FIELD OF THE INVENTION

The invention is directed to a method and an arrangement for management of bearers in cellular telecommunication systems in such a situation, when the demand of services is greater than the capacity of the network to provide such services.

BACKGROUND OF THE INVENTION

For clarification of common terms used in this document, an overview of certain cellular telecommunication system configurations is presented in the following.

Proposals for third-generation systems include UMTS (Universal Mobile Telecommunications System) and FPLMTS/IMT-2000 (Future Public Land Mobile Telecommunications System / International Mobile Telecommunications at 2000 MHz). In these plans cells are categorised according to their size and characteristics into pico-, nano-, micro- and macrocells, and an example of the service level is the bit rate. The bit rate is the highest in picocells and the lowest in macrocells. The cells may overlap partially or completely and there may be different terminals so that not all terminals necessarily are able to utilise all the service levels offered by the cells.

Fig. 1 shows a version of a future cellular radio system which is not entirely new compared with the known GSM system but which includes both known elements and completely new elements. In current cellular radio systems the bottleneck that prevents more advanced services from being offered to the terminals comprises the radio access network RAN which includes the base stations and base station controllers. The core network of a cellular radio system comprises mobile services switching centres (MSC), other network elements (in GSM, e.g. SGSN and GGSN,

i.e. Serving GPRS Support Node and Gateway GPRS Support node, where GPRS stands for General Packet Radio Service) and the related transmission systems. According e.g. to the GSM+ specifications developed from GSM the core network can also provide new services.

In Fig. 1, the core network of a cellular radio system 930 comprises a core network CN 931 which has three parallel radio access networks linked to it. Of those, networks 932 and 933 are UMTS radio access networks and network 934 is a GSM radio access network. The upper UMTS radio access network 932 is e.g. a commercial radio access network, owned by a telecommunications operator offering mobile services, which equally serves all subscribers of said telecommunications operator. The lower UMTS radio access network 933 is e.g. private and owned e.g. by a company in whose premises said radio access network operates. Typically the cells of the private radio access network 933 are nano- and/or picocells in which only terminals of the employees of said company can operate. All three radio access networks may have cells of different sizes offering different types of services. Additionally, cells of all three radio access networks 932, 933 and 934 may overlap either entirely or in part. The bit rate used at a given moment of time depends, among other things, on the radio path conditions, characteristics of the services used, regional overall capacity of the cellular system and the capacity needs of other users. The new types of radio access networks mentioned above are called generic radio access networks (GRAN). Such a network can co-operate with different types of fixed core networks CN and especially with the GPRS network of the GSM system. The generic radio access network (GRAN) can be defined as a set of base stations (BS) and radio network controllers (RNC) that are capable of communicating with each other using signaling messages. Below, the generic radio access network will be called in short a radio network GRAN.

The terminal 935 shown in Fig. 1 is preferably a so-called dual-mode terminal that can serve either as a second-generation GSM terminal or as a third-generation

UMTS terminal according to what kind of services are available at each particular location and what the user's communication needs are. It may also be a multimode terminal that can function as terminal of several different communications systems according to need and the services available. Radio access networks and services available to the user are specified in a subscriber identity module 936 (SIM) connected to the terminal.

In UMTS specifications, a SIM is denoted with the term USIM (UMTS SIM). One mobile communication means (ME, mobile equipment) such as a cellular telephone can have more than one USIM connected to the terminal. This is useful, for example, for providing a person with a private telephone number with a first USIM and another number for work-related calls with a second USIM. The person can then receive calls to all of these telephone numbers with the same ME comprising the two USIMs, and bar any calls to any of these telephone numbers at his/her leisure. For example, the person can bar any calls to the work-related number at weekends and allow only calls to his/her private number. The USIMs may be separate IC cards, whereby the ME is required to have more than one USIM connector for connecting the USIMs, or a single IC card may comprise more than one logical USIMs.

In cellular telecommunication systems a single speech connection or data connection through the cellular telecommunication network is called a bearer. Generally, a bearer is associated with a set of parameters pertaining to data communication between a certain terminal equipment and a network element, such as a base station or an interworking unit (IWU) connecting the cellular network to another telecommunications network. The set of parameters associated with a bearer comprises typically for example data transmission speed, allowed delays, allowed bit error rate (BER), and the minimum and maximum values for these parameters. A bearer may further be a packet transmission bearer or a circuit switched bearer and support for example transparent or non-transparent connections. A bearer can be

thought of as a data transmission path having the specified parameters connecting a certain mobile terminal and a certain network element for transmission of payload information. One bearer always connects only one mobile terminal to one network element. However, a bearer can pass through a number of network elements. One mobile communication means (ME, Mobile Equipment) may in some cellular telecommunication systems support one bearer only, in some other systems also more than one simultaneous bearers.

One old problem in cellular telecommunication systems is how to handle situations, in which the demand of services at some area in a cellular telecommunication system exceeds the capability of the cellular telecommunication system to provide such services. This problem is more severe in the UMTS system presently under development and other systems, where a mobile communication means (ME) can have more than one simultaneous connections i.e. bearers. A method is needed for determining, which current bearers are dropped or which new bearers are allowed in an overload situation.

One example of a typical overload situation is the handover of a connection to a crowded cell. One conventional way of handling this situation is simply to refuse the handover, which may result in a broken connection. The situation is more complicated, if the ME has several connections, and the new cell has spare capacity for only a subset of those connections. In such a situation, a method is needed for selecting which connections are serviced and which connections are refused.

One further example of a problematic situation is such a situation, when the capacity of a cell is already in full use, and one ME requests for example an increase in data transmission rate or a group of new bearers.

SUMMARY OF THE INVENTION

An object of the invention is to alleviate problems associated with cell overload situations. A further object of the invention is to realize a method for selection of bearers, which are to be denied of service in an overload situation. An object of the invention is also to realize a method for prioritizing of bearers.

The objects are reached by defining a multilevel priority scheme for bearers, which allows flexible allocation of resources for bearers having widely differing parameters.

The method according to the invention for management of bearers in a cellular telecommunications system is characterized by that

- at least two priority data items are associated with each bearer, and
- decisions whether or not to provide services for a bearer are based at least in part on the value of at least one of said at least two priority data items.

The cellular telecommunications system according to the invention is characterized by that for management of bearers

- at least two priority data items are arranged to be associated with each bearer, and
- decisions whether or not to provide services for a bearer are arranged to be based at least in part on the value of at least one of said at least two priority data items.

A radio network controller according to the invention for a cellular telecommunications system is characterized by that for management of bearers it comprises

- means for associating at least two priority data items with each bearer, and
- means for making decisions whether or not to provide services for a bearer based at least in part on the value of at least one of said at least two priority data items.

The dependent claims describe further advantageous embodiments of the invention.

The invention relates to alleviating problems in those situations, where a radio access network cannot support all present or requested bearers. According to the invention, a set of priority values is associated with each bearer. Preferably, the set of priority values comprises an absolute priority value, which is the same for all bearers associated with a certain USIM, and a relative priority value, which defines the priority order of the bearers associated with a certain USIM. The network uses these priority values to determine, which bearer is dropped, when not enough resources are available.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in more detail in the following with reference to the accompanying drawings, of which

Figure 1 illustrates the general structure of a cellular telecommunication network according to prior art,

Figure 2 illustrates one example of selection of bearers to be serviced according to an advantageous embodiment of the invention,

Figure 3 illustrates one example of signalling according to an advantageous embodiment of the invention,

Figure 4 illustrates one example of a telecommunications system and a radio network controller according to the invention.

Same reference identifiers are used for similar entities in the figures.

DETAILED DESCRIPTION

According to an advantageous embodiment of the invention, a two-level priority scheme is used. For each client identity, an absolute priority value is assigned, and for each bearer, a relative priority value. Such a two-level priority scheme using two priority data items allows on the one hand treatment of all bearers of a client identity as a single unit on a client-by-client basis, and on the other hand treatment of all bearers of all client identities on a bearer-by-bearer basis.

Treatment of all bearers of a client identity as a single unit can be effected by using only one of the priority values as the basis for bearer servicing decisions. Preferably, the absolute priority associated with the client identity is used as the basis for decisions. Treatment of all bearers of a client identity as a single group is useful e.g. in handover situations, when the network decides, whether or not to allow a handover to occur.

In some situations it is advantageous to prioritize the use of transmission capacity on a bearer-by-bearer basis. In such cases, both the absolute and the relative prioritization can be used for selecting the bearers to be dropped first. Advantageously, those bearers which have the lowest relative priority of the client identities having lowest absolute priority, are dropped first. Such an approach is advantageous for example in air interface congestion situations.

The client identity referred to in the previous paragraphs is in an advantageous embodiment of an invention the identity of a single USIM, as the following examples in the description of various figures of this specification show. However, the invention is not limited to such an embodiment. A client identity can also comprise multiple USIMs. For example, a client identity may also refer to a single

ME having multiple USIMs, whereby the client identity comprises multiple USIM identities.

The absolute priority value of each USIM may advantageously be stored in the USIM. The absolute priority value may be different between different USIMs, also in cases where a single ME comprises more than one USIMs. Further, an operator may set the price of an USIM according to the absolute priority level of the USIM. The absolute priority is preferably the same for all bearers associated with the same USIM. The relative priority value can advantageously be used to distinguish the bearers associated with the same USIM. This relative priority value of each bearer can advantageously be assigned automatically during the setup of the bearer, for example, by the call control entity for that particular USIM.

Figure 2 illustrates selection of serviced bearers according to an advantageous embodiment of the invention. Figure 2 shows three mobile communication means ME1, ME2, ME3 which already have connections to a base station. In this example, we assume that the base station is able to support eight bearers. As shown in Figure 2, the first mobile ME1 has two USIMs USIM11, USIM12, the second mobile ME2 one USIM USIM21 and the third mobile ME3 one USIM USIM31. In the initial situation as shown by the left side of the figure, the first mobile ME1 has four bearers, three of the bearers associated with the first USIM USIM11 and one with the second USIM USIM12. The second mobile ME2 has only one bearer, and the third mobile ME3 two bearers. The bearers have two priority levels, the higher level called the absolute priority A3, A5 being associated with the USIM and the lower level called the relative priority R1, R2, R3 being associated with each bearer. As one can see from Figure 2, the three bearers associated with USIM11 have the lowest absolute priority value A5, while the other bearers have a middle priority of A3. In the example of Figure 2, it is assumed that the absolute priority values range from A1 to A5, the latter being the lowest priority.

The range of priority values is not limited in any way by the present invention. The range may comprise more or less than five values, and the order of priority values may be different from that explained in the previous paragraph.

At this initial situation, a fourth mobile ME4 is switched on, and the user of ME4 wishes to start communication using two bearers for example to have a video telephone call. Consequently, ME4 signals a request to the network to set up two bearers. Alternatively, ME4 could represent a mobile moving from another cell towards the cell servicing ME1, ME2, and ME3, and require a handover.

The USIM of ME4 has the absolute priority level A3 associated with it. Upon reception of the request, the network examines the bearer situation of the base station and finds out, that only one more bearer can be accommodated. Since two bearers were requested, one bearer must be denied service, either one of the requested bearers or one of currently serviced bearers. In this case, there are three currently active bearers having a lower absolute priority value than the requested bearers, namely the bearers of ME1 associated with the first USIM USIM11 of ME1. Consequently, the network decides to drop the bearer having the lowest relative priority value among the three bearers BEARER111, BEARER112, BEARER113 of USIM11, thereby creating free capacity to accommodate the requested two new bearers of ME4. As a result, the bearer situation of the base station becomes as shown in the right side of Figure 2.

The selection of bearers may in various embodiments of the invention be different from that shown in the example of Figure 2. In one advantageous embodiment of the invention where all bearers of a client identity such as a USIM are treated in a single group, all bearers of the first USIM USIM11 of ME1 are dropped instead of only one as shown in Figure 2, since they have the lowest absolute priority value of all active bearers and bearer requests.

Advantageously, each USIM has an associated default absolute priority level, which is assigned to each new bearer. In further advantageous embodiments of the invention, a user can change the priority settings of his/her connections to ensure that he/she receives the desired service from the network. Naturally, the network operator may change the charges levied per connection time or per transmitted amount of data as a result of change of priority settings. Advantageously, the user may change the absolute priority level of any of his/her USIMs, and the relative priority level of any active bearer. Further, the user may change the default priority levels, or the desired priority level for the next connection requested. In further advantageous embodiments, the user may change the priorities of currently active bearers during the connection. Changing of priority of currently active bearers is advantageous for example when the user is downloading a large file to the ME, and wishes to speed up the process by temporarily increasing the priority of the bearer.

On the other hand, the network may start to select the bearers to be serviced for many reasons. For example, when the air interface becomes congested at a so called hot spots, for example during mass events when large crowds of people are present at one location, the network may increase the required priority levels to cope with the overload. A further example is a decrease of the capacity of a base station due to e.g. malfunctioning of a transmitter of the base station.

In an overload situation, the network may offer a possibility to the user to choose to increase the priority level and accept higher connection charges in order to avoid termination of his/her connections. In an advantageous embodiment of the invention, the user may set default preferences for his/her USIMs specifying, if and within which limits the priority levels of the user's connections may be automatically changed during overload situations.

In various embodiments of the invention, the user may adjust any of the priority values. The user may, for example, increase the absolute priority values to increase

the service level of all of his bearers. Naturally, the network operator may adjust the charges accordingly.

In one advantageous embodiment, the operator may set a required minimum priority for a certain cell or for any number of cells or even for the whole network, which minimum priority must be matched or exceeded in order to obtain any service from the network.

In another advantageous embodiment of the invention, the bearer request does not contain an explicit indication of a priority. Instead, the network chooses the priority based on the information contained in the bearer request, for example the type of bearer requested. For example, if the user requests an expensive service, the network chooses a relatively high priority to be used for that bearer.

As previously described, a user may advantageously change the priority values during a connection. For example, during a multimedia session different multimedia components, each one forming a separate bearer, are often added or removed, whereby the preferences given at call setup may no longer correspond to the current wish of the user. The user may therefore wish to modify the relative priority of his/her bearers. One example of a signalling procedure for priority modification according to an advantageous embodiment of the invention is shown in Figure 3. The connections are controlled by the Call Control (CC) entities in the core network. The decisions on whether or not to provide radio service for a bearer are made in the radio access network RAN. The priority values are stored in the RAN. Figure 3 shows the signalling between a call control entity ME-CC 10 in a mobile communication means, a corresponding peer entity CN-CC 20 in the core network, and the radio access network RAN 30. After the user instructs the mobile communication means to increase the priority of a bearer, the ME-CC 10 sends a MODIFY_REQUEST message 110 to the CN-CC 20. The CN-CC invokes a priority modification procedure in the radio access network RAN 30 by sending a

MODIFY_PRIORITY message 120 to the radio access network RAN 30. After receiving the MODIFY_PRIORITY command, the radio access network modifies 130 the priority of the bearer as desired. When the radio access network has completed the priority modification, it sends 140 an acknowledgement MODIFY_PRIORITY_ACK message back to CN-CC. The CN-CC finishes the messaging by sending 150 an acknowledgement MODIFY_REQUEST_ACK message to ME-CC.

A terminal can modify several bearers substantially simultaneously by initiating the negotiation procedure separately for each bearer in succession. In another advantageous embodiment, a list of bearer identities is attached as a parameter to the MODIFY_REQUEST message.

Fig. 4 shows an example of a telecommunications system and a radio network controller according to the invention. The radio network comprises radio network controllers RNC1, RNC2 and RNC3. Base stations BS1, BS2 and BS3 are controlled by the radio network controller RNC0, base stations BS4, BS5 and BS6 are controlled by the radio network controller RNC1, and base stations BS7, BS8 and BS9 are controlled by the radio network controller RNC2. A mobile equipment ME is connected by radio to the system, via the base stations and radio network controllers. In Fig. 4 the base station BS5 is active, ie. the data transfer between the system and the mobile equipment is routed via the base station BS5. There can also be several active base stations, if macro diversity is used. It should be noted that Fig. 4 shows only a fraction of the usual number of radio network controllers and base stations in a radio network.

The radio network controller may comprise the following logical units. The logical link control LLC controls the radio connections between the radio network controller and a mobile equipment. The tasks of the logical link control LLC may include error detection, error correction and retransmission in error situations. In

addition, the logical link control LLC may comprise control for the necessary buffers and acknowledge windows. The macrodiversity controller MDC performs the functions that belong to macrodiversity combining according to the possible macrodiversity implementation used. The set controller SC controls the active set of base stations. The radio network controller according to the invention also comprises means PM for associating priority data items with a bearer, and means DM for making decisions whether or not to provide services for the bearer based on the value of the priority data items. The means PM and DM can be realized as parts of other logical means of the radio network controller, or they can be separate logical means in the radio network controller.

The invention is not limited to using a two-level priority scheme as explained in the previous examples. For example, in an advantageous embodiment of the invention, a three-level priority scheme is used, i.e. three priority data items are associated with each bearer. In such an embodiment, the highest level priority value is associated with the ME, the middle level priority value is associated with each USIM connected with the ME, and the lowest level priority value is associated with the bearers of the USIMs. In such an embodiment, the selection of bearers to be serviced may proceed in a way analogous to the selection in a two-level scheme, e.g. starting the dropping of bearers from that group of bearers which has lowest values of the two higher priority levels, and dropping first those bearers having the lowest bearer-associated priority level. Further, a three-level priority scheme is advantageous for example when a ME comprising more than one USIM attempts to perform a handover to another cell. In such a situation it is advantageous, that all bearers of the ME can be treated as a single group when the network determines, whether or not to allow the handover to occur. In such a situation the ME advantageously has a priority value associated to it, which value is used by the network in said determination.

The priority scheme according to the invention can also be used in other situations than network overload situations. For example, instead of affecting the selection of bearers denied or allowed, the priorities may also affect the service level such as transmission capacity allocated for a bearer. For example, by setting the priority levels of his bearers high enough, the user may obtain better and faster service than other users with lower priority levels. With the inventive priority scheme, a user may obtain almost any service level he desires, and can adjust the obtained service level at any time by adjusting the priority values. The priority scheme further allows the network to reduce the level of service given to bearers having low priority, and thus avoid an overload situation altogether.

The name of a given functional entity, such as the radio network controller, is often different in the context of different cellular telecommunication systems. For example, in the GSM system the functional entity corresponding to a radio network (RNC) is the base station controller (BSC). Further, the various command names such as the MODIFY_REQUEST command name are intended to be examples only, and the invention is not limited to using the command names recited in this specification.

In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention. While a preferred embodiment of the invention has been described in detail, it should be apparent that many modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention.

Claims

1. A method for management of bearers in a cellular telecommunications system, **characterized** in that
 - at least two priority data items are associated with each bearer, and
 - decisions whether or not to provide services for a bearer are based at least in part on the value of at least one of said at least two priority data items.
2. A method according to Claim 1, **characterized** in that the bearers are organized into sets on at least two hierarchical levels and a priority data item is given for each set.
3. A method according to Claim 2, **characterized** in that one of the hierarchical levels is the level of one bearer, and the sets on that level comprise one bearer.
4. A method according to any of the preceding Claims, **characterized** in that one of the hierarchical levels is the level of client identity, and the sets on that level comprise the bearers of that client identity.
5. A method according to any of the preceding Claims, **characterized** in that
 - at least two sets of decisions on providing service are defined,
 - a first combination of the priority data items is used in a first set and
 - a second combination of the priority data items is used in a second set.
6. A method according to any of the preceding Claims, **characterized** in that all bearers associated with the same client identity have the same values of a first priority data item of said at least two priority data items.
7. A method according to Claim 6, **characterized** in that the value of the first priority data item is stored in the USIM.

8. A method according to Claim 6 or 7, **characterized** in that said client identity is the identity of a USIM.
9. A method according to any of the preceding Claims, **characterized** in that at least one of the priority data items is allocated during the bearer setup procedure.
10. A method according to any of the preceding Claims, **characterized** in that at least one priority data item is changed during the connection.
11. A method according to Claim 9 or 10, **characterized** in that the priority data item is determined by the mobile station.
12. A method according to Claim 9 or 10, **characterized** in that the priority data item is determined by the network.
13. A method according to any of the preceding Claims in a telecommunications system comprising a radio access network, a core network and a mobile equipment wherein
- the decisions on whether or not to provide the radio service for the connection are made in the radio access network and
 - the priority items are stored in the radio access network,
- characterized** in that
- the mobile equipment sends the core network entity controlling the bearer a request to change the value of a priority data item and the core network requests the radio access network to change the value of the priority data item.
14. A method according to any of the preceding Claims, **characterized** in that at least a required minimum value for a priority data item is defined and the bearers having a priority data item value smaller than the required minimum priority value are not given resources.

15. A cellular telecommunications system, **characterized** in that for management of bearers

- at least two priority data items are arranged to be associated with each bearer, and
- decisions whether or not to provide services for a bearer are arranged to be based at least in part on the value of at least one of said at least two priority data items.

16. A cellular telecommunications system according to Claim 15, **characterized** in that the bearers are organized into sets on at least two hierarchical levels and a priority data item is given for each set.

17. A cellular telecommunications system according to Claim 15 or 16, **characterized** in that

- at least two sets of decisions on providing service are defined,
- a first combination of the priority data items is used in a first set and
- a second combination of the priority data items is used in a second set.

18. A radio network controller for a cellular telecommunications system, **characterized** in that for management of bearers it comprises

- means for associating at least two priority data items with each bearer, and
- means for making decisions whether or not to provide services for a bearer based at least in part on the value of at least one of said at least two priority data items.

19. A radio network controller according to Claim 18, **characterized** in that it comprises means for organizing the bearers into sets on at least two hierarchical levels and for giving a priority data item for each set.

20. A radio network controller according to Claim 18 or 19, **characterized** in that it comprises

- means for defining at least two sets of decisions on providing service,
- means for using a first combination of the priority data items in a first set and
- means for using a second combination of the priority data items in a second set.

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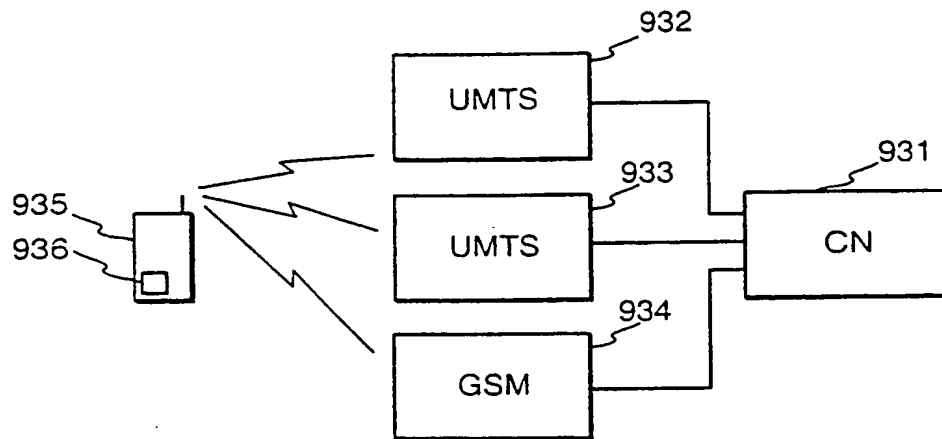


Fig. 1

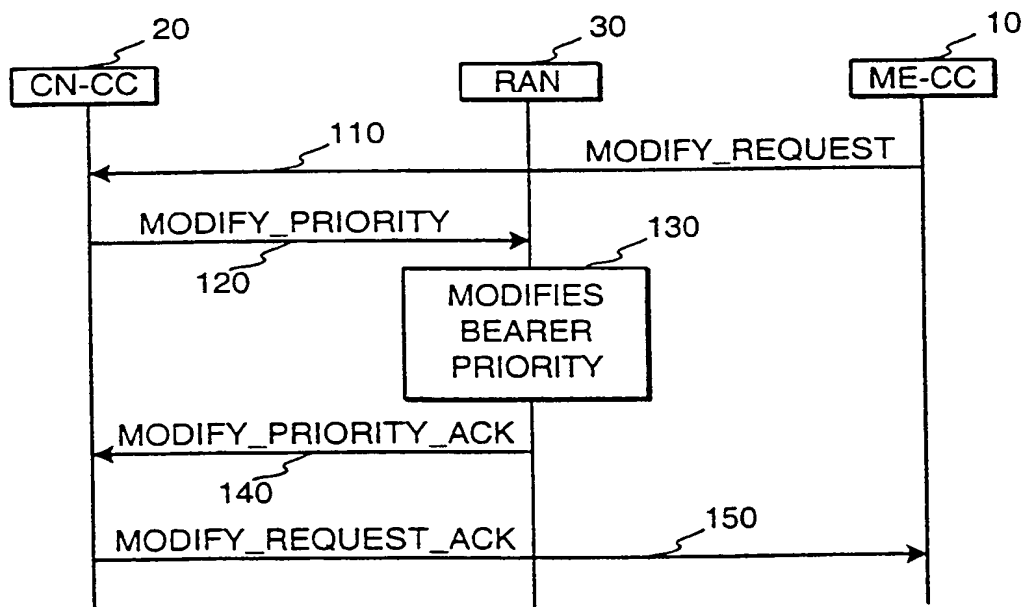


Fig. 3

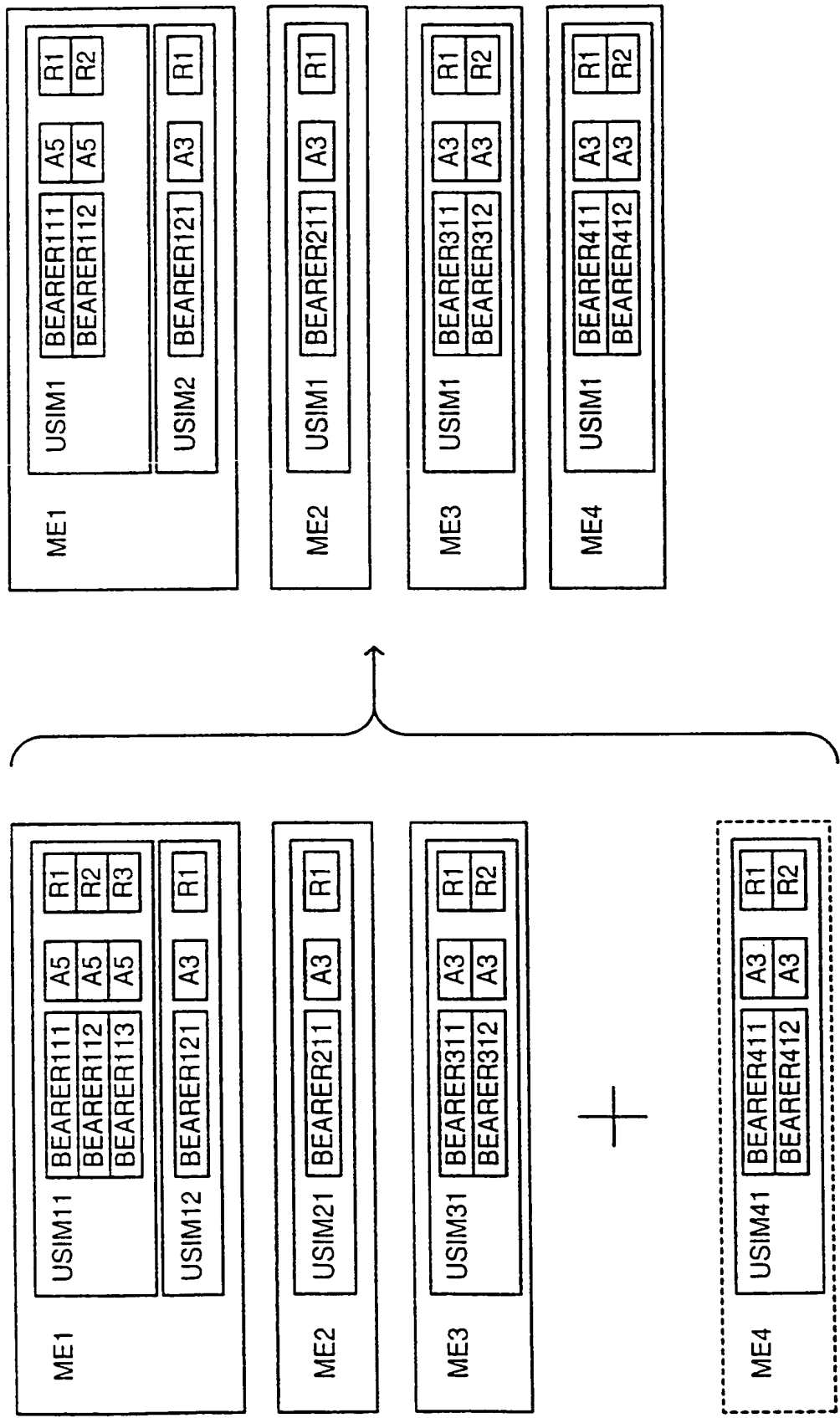


Fig. 2

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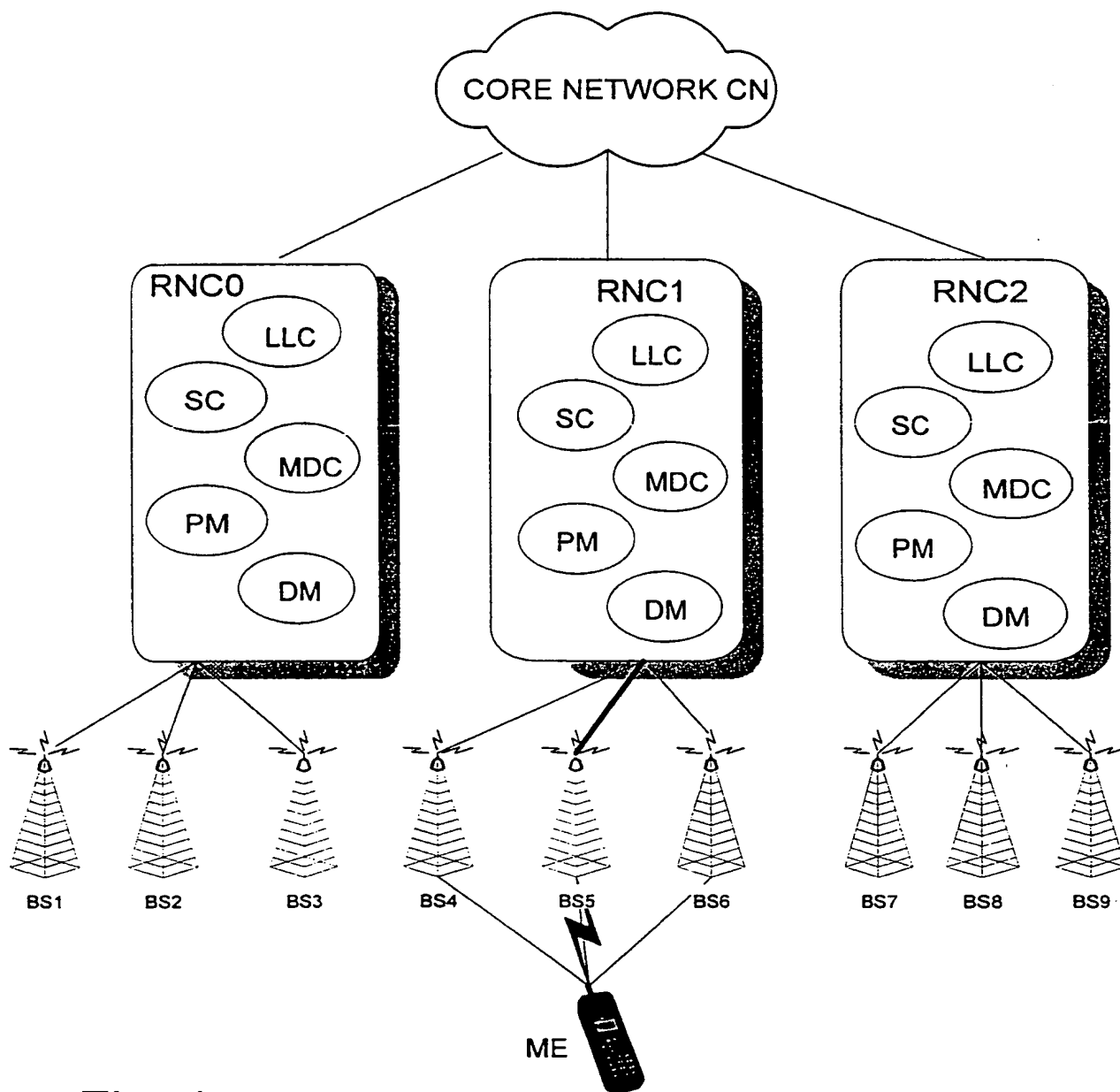


Fig. 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT/FI 99/00636

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	IERA ET AL.: "Call-Level" and "Burst-Level" Priorities for an Effective Management of Multimedia Services in UMTS" PROCEEDINGS OF IEEE INFOCOM 1996.FIFTEENTH ANNUAL JOINT CONFERENCE OF THE IEEE COMPUTER AND COMMUNICATIONS SOCIETIES.NETWORKING THE NEXT GENERATION., vol. 3, 24 - 28 March 1996, pages 1363-1370, XP000622274 San Francisco, usa the whole document	1-20
A	EP 0 717 579 A (AT&T) 19 June 1996 (1996-06-19) abstract; figures 1-4 column 5, line 4 - line 12 column 8, line 11 - line 20	1,4,10, 13,14



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

27 October 1999

Date of mailing of the international search report

05/11/1999

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/FI 99/00636

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>W0 97 11566 A (MOTOROLA INC.) 27 March 1997 (1997-03-27) abstract; figures 1,9,10 page 12, line 12 - line 29 -----</p>	1,13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/FI 99/00636

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			JP	8237724 A	13-09-1996
WO 9711566	A	27-03-1997	US	5742592 A	21-04-1998
			EP	0847652 A	17-06-1998
			US	5729542 A	17-03-1998